

REMARKS

Claim 11 is amended to include limitations previously in claim 17. Claims 1, 3, 5, 6-11, 14-16, and 18-20 are pending.

Claim 1

Claims 1, 8, 10, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Biing-Jye et al., U.S. Patent No. 6,169,294 (hereinafter "Biing-Jye") in view of Hunt et al., U.S. Patent No. 5,362,977 (hereinafter "Hunt"), and further in view of Ishikawa et al, U.S. Patent 5,696,389 (hereinafter "Ishikawa").

Claim 1 recites "a multi-layer contact external to the semiconductor heterostructure, the multi-layer contact comprising: a metallic reflector layer; a continuous uniform conducting sheet that makes ohmic contact to the heterostructure; and a conductive barrier layer interposing the reflector layer and the continuous uniform conducting sheet." Thus, each of the metallic reflector layer, the continuous uniform conducting sheet, and the conductive barrier layer must be external to the semiconductor heterostructure of the device.

The Examiner's rejection clearly ignores the above-underlined portion of claim 1. The Examiner cites Ishikawa as teaching "a conductive barrier (128) interposing a reflector layer (127) and a continuous uniform conducting sheet (129)." See office action, page 3. Actually, Ishikawa at column 9, line 49 refers to layer 128 as a "hetero-barrier reducing layer." Layer 128 is thus likely a semiconductor layer, not a layer external to the semiconductor heterostructure. In any case, Ishikawa does not specify whether or not layer 128 is a semiconductor layer. Thus, Ishikawa does not teach a barrier layer external to the semiconductor heterostructure, as recited in claim 1.

Accordingly, even in combination, Biing-Jye, Hunt, and Ishikawa do not teach all the elements of claim 1. Claims 8, 10, and 19 depend from claim 1 and are therefore allowable for at least the same reason.

In addition, regarding claim 8, Applicants do not understand how Figure 2A of Biing-Jye teaches p and n contacts formed on opposing faces of the heterostructure, since Figure 2A clearly illustrates a flip chip or epitaxy-up LED, where the contacts are formed on the same side of the semiconductor heterostructure.

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Biing-Jye, Hunt, and Ishikawa as applied to claim 1, further in view of Sugiura et al., U.S. Patent 5,932,896 (hereinafter "Sugiura"). Claim 3 depends from claim 1. Sugiura adds nothing to the deficiencies of Biing-Jye, Hunt, and Ishikawa with respect to claim 1, thus claim 3 is allowable for at least the same reasons as claim 1.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Biing-Jye, Hunt, and Ishikawa as applied to claim 1 and further in view of Nakagawa et al., U.S. Patent No. 6,190,937 (hereinafter "Nakagawa"). Claim 5 depends from claim 1. Nakagawa adds nothing to the deficiencies of Biing-Jye, Hunt, and Ishikawa with respect to claim 1 thus claim 5 is allowable for at least the same reasons as claim 1.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Biing-Jye, Hunt, and Ishikawa as applied to claim 1 and further in view of Liu et al., U.S. Patent No. 5,789,771 (hereinafter "Liu"). Claim 6 depends from claim 1. Liu adds nothing to the deficiencies of Biing-Jye, Hunt, and Ishikawa with respect to claim 1, thus claim 6 is allowable for at least the same reasons as claim 1. In addition, the Examiner cites Liu as teaching a particular thickness for a conductive sheet in a multi-layer contact external to the semiconductor heterostructure. Actually, the passage quoted by the Examiner deals with the thickness of a semiconductor layer, not a part of a multi-layer contact that is external to the semiconductor heterostructure. In response to this argument, the Examiner states "claims 6 and 16 do not claim a thickness of the multi-layer contact but a thickness of the sheet that makes ohmic contact." The Examiner's argument ignores the plain language of claim 1,

which recites that the entire multi-layered contact, including the continuous uniform conducting sheet that makes ohmic contact to the heterostructure, is external to the semiconductor heterostructure. Accordingly, claim 6 is allowable for this additional reason.

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Biing-Jye, Hunt, and Ishikawa as applied to claim 1, and further in view of Schetzina, U.S. Patent No. 5,351,255. Claim 7 depends from claim 1. Schetzina adds nothing to the deficiencies of Biing-Jye, Hunt, and Ishikawa with respect to claim 1, thus claim 7 is allowable for at least the same reasons as claim 1.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Biing-Jye, Hunt, and Ishikawa as applied to claims 1 and 8 and further in view of Haitz et al., U.S. Patent No. 5,917,202. Claim 9 depends from claim 1. Haitz et al. adds nothing to the deficiencies of Biing-Jye, Hunt, and Ishikawa with respect to claim 1, thus claim 9 is allowable for at least the same reasons as claim 1.

Claim 11

Claims 11, 14, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Biing-Jye in view Hunt and Sugiura.

Claim 11 recites a multi-layer contact comprising "a metallic reflector layer selected from the group of Al, Rh, and Ag; and a continuous uniform conducting sheet that makes ohmic contact to the heterostructure; wherein the multi-layer contact has a reflectivity greater than 75% for light at an operating wavelength of the light-emitting device and wherein the multi-layer contact has a specific contact resistance less than $10^{-2} \Omega\text{-cm}^2$." Thus claim 11 recites a device with contact including a reflector layer and an ohmic contact layer, where BOTH the reflectivity and the resistance across the entire contact are controlled. The reflectivity and contact resistance may depend on, for example, the materials used in the contact, the structure and thickness of the contact.

The Examiner rejects claim 11 using Biing-Jye as a base reference, then using Hunt to supply a contact reflectivity, and Sugiura to supply a contact resistance. However, there is no suggestion or expectation in any of the references that using Hunt's reflective contact would result in a contact with the claimed resistance, and that using Sugiura's low resistance contact would result in a contact with the claimed reflectivity. For example, a person of skill in the art would not expect the Pd/Ti/Pt/Au contact of Sugiura to have a reflectivity greater than 75%, as recited in claim 1. If other metals, such as Al, Rh, and Ag, the metals recited in claim 11, were substituted in the contact structure of Sugiura to boost the reflectivity, a person of skill in the art would expect that the contact resistance would no longer meet the requirement of claim 11.

The Examiner's statement that "it would have been obvious to . . . use the contact resistance which is less than $0.01 \Omega\text{-cm}^2$ of Sugiura et al. in the light-emitting device of Biing-Jye et al. and Hunt et al. in order to improve ohmic contact as taught by Sugiura" is absurd because it ignores the physical realities of designing a contact. Given a contact of a particular reflectivity, a person cannot simply choose to "use" a particular contact resistance, because the contact resistance depends on the materials used and the structure of the contact. Similarly, given a contact of a particular resistance, a person cannot simply choose to "use" a particular reflectivity, because the reflectivity depends on the materials used and the structure of the contact. Since there is no expectation that the contacts of Hunt and Sugiura can be combined to successfully yield a contact with BOTH the claimed reflectivity and the claimed contact resistance, the Examiner has failed to make a prima facie case of the obviousness of claim 11. Claims 14 and 20 depend from claim 11 and are therefore allowable for at least the same reason.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Biing-Jye, Hunt, and Sugiura as applied to claim 11 and further in view of Nakagawa et al. Claim 15

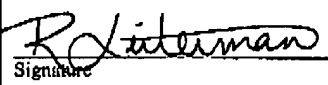
depends from claim 11. Nakagawa adds nothing to the deficiencies of Biing-Jye, Hunt, and Sugiura with respect to claim 11 thus claim 15 is allowable for at least the same reasons as claim 11.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Biing-Jye, Hunt, and Sugiura as applied to claim 11 and further in view of Liu. Claim 16 depends from claim 11. Liu adds nothing to the deficiencies of Biing-Jye, Hunt, and Sugiura with respect to claim 11, thus claim 16 is allowable for at least the same reasons as claim 11. In addition, the Examiner cites Liu as teaching a particular thickness for a conductive sheet in a multi-layer contact external to the semiconductor heterostructure. Actually, the passage quoted by the Examiner deals with the thickness of a semiconductor layer, not a part of a multi-layer contact that is external to the semiconductor heterostructure. In response to this argument, the Examiner states "claims 6 and 16 do not claim a thickness of the multi-layer contact but a thickness of the sheet that makes ohmic contact." The Examiner's argument ignores the plain language of claim 11, which recites that the entire multi-layered contact, including the continuous uniform conducting sheet that makes ohmic contact to the heterostructure, is external to the semiconductor heterostructure. Accordingly, claim 16 is allowable for this additional reason.

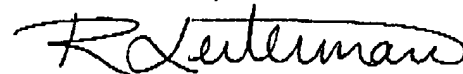
Claim 17 is canceled, rendering its rejection moot.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Biing-Jye and Hunt as applied to claim 11 further in view of Okazaki, U.S. Patent No. 5,990,500. Claim 18 depends from claim 11. Okazaki adds nothing to the deficiencies of Biing-Jye, Hunt, and Sugiura with respect to claim 11, thus claim 18 is allowable for at least the same reasons as claim 11.

In view of the above arguments, Applicants respectfully request allowance of all pending claims. Should the Examiner have any questions, the Examiner is invited to call the undersigned at (408) 382-0480.

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Respectfully submitted,



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